IN THE

Supreme Court of the United States

OCTOBER TERM, 1975

NO. ...75-1780

METALLURGICAL EXOPRODUCTS CORPORATION, Petitioner,

v.

PITTSBURGH METALS PURIFYING COMPANY, INC., Respondent.

PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE THIRD CIRCUIT

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To The Honorable Chief Justice and the Associate Justices of the Supreme Court of the United States:

Petitioner, Metallurgical Exoproducts Corporation (MEC), respectfully prays that a writ of certiorari issue to review the judgment of the United States Court of Appeals for the Third Circuit entered in this case on March 8, 1976.

THE OPINIONS BELOW.

The opinion for the United States District Court is reported at 393 F. Supp. 1104 (W.D. Pa., 1975). It is printed in Appendix C to this petition at pages 10a to 17a. The opinion of the Court of Appeals for the Third Circuit is unreported, and it is marked by the Court "Not for Publication." The opinion is printed in Appendix A at pages 1a to 8a.

JURISDICTION.

The judgment of the Court of Appeals (App. B, p. 9a) was entered March 8, 1976. This petition is being filed within 90 days thereof.

The jurisdiction of this Court is invoked pursuant to 28 U.S.C., Section 1254(1). Jurisdiction in the District Court was based upon 28 U.S.C., Section 1338(a) and in the Court of Appeals upon 28 U.S.C., Section 1291.

QUESTIONS PRESENTED FOR REVIEW.

1. Where the subject matter of a patent has solved a problem which was so basic that those in the art considered it inherent in the art of steelmaking, is not the subject matter of that patent above the level of ordinary skill in the art?

2. Does not a combination of mechanical elements produce a synergistic result where the coaction or interdependent functioning of the mechanical elements solves a problem termed basic because it was believed to be inherent in the art of steelmaking?

CONSTITUTIONAL PROVISIONS AND STATUTES INVOLVED.

The questions presented involve Article I, Section 8, Clause 8 of the Constitution which provides, in part, that the Congress shall have power

> "To promote the Progress of . . . useful Arts, by securing for limited Times to . . . Inventors the exclusive Right to their . . . Discoveries."

They also involve Section 103 of the Patent Act of 1952, Title 35 U.S.C., which states:

> "A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made."

STATEMENT OF THE CASE.

Petitioner, MEC, is the assignee of Koch and Rocher United States Patent No. 3,421,731 issued January 14, 1969. The patent relates to a hot top maintaining system and is referred to hereinafter as the "Koch et al. patent." A copy of the patent is reproduced in Appendix D, page 19a.

In the art of making steel, molten steel is poured into an ingot mold to cool and solidify. As the steel cools, it tends to form a central cavity or "pipe" in the ingot. The presence of "pipe" is undesirable since the portion of the ingot containing the "pipe" is unusable and must be scrapped. To eliminate undesirable "pipe," various forms of hot tops have been developed. The hot tops are placed in or at the top of the ingot mold in order to maintain a reservoir of molten steel at the top of the mold so that, as the ingot cools, the molten steel in the hot top will fill the portions of the ingot which otherwise would form "pipe."

Hot tops have been used in the steel industry since the early 1900's. Early hot tops were large, integral four-sided structures that were placed on top of or inside the top portion of an ingot mold. Later, these bulky and unwieldy hot tops were replaced by hot tops composed of a plurality of sideboards made of a refractory or insulating material.

Sideboards are easier to handle than the unitary hot tops; however, if sideboards are not securely held against the wall of the ingot mold, they will float due to the buoyancy force of the molten metal. When this occurs, the hot top system cannot perform its intended function. Although the effect of the buoyancy force on sideboards has been known since sideboards first replaced unitary hot tops, floating sideboards have been a major problem.

The District Court characterized the floating problem as "basic" and found that the patent in suit "solved problems that were 'basic' in the sense that they had persisted for a long time and thus seemed to be inherent in the process of steelmaking" (App. C, p. 15a).

The Koch et al. patent is directed to a hot top maintaining system designed to eliminate or minimize the floating problem. And the District Court found that the hot top system disclosed and claimed in the Koch et al. patent did in fact resolve "a long standing problem in the steel industry" (App. C, p. 16a).

The hot top maintaining system described and claimed in the Koch et al. patent comprises four sideboards suspended from the top of an ingot mold. Each board has a pair of downwardly and outwardly inclined grooves near the ends so that the grooves near the end of adjacent sideboards have a downward convergency. A metal wedge plate is inserted into the downwardly converging grooves positively forcing the sideboards against the walls of the ingot mold. The District Court found that the patented system was "based on the *coaction** between inclined, converging grooves in the sideboards and wedge plates" (App. C, p. 13a) and further that it was "the *coaction* between the grooves and the wedges which prevents the sideboards from floating" (App. C, p. 13a) thereby solving the problem it termed "basic" because it seemed to be inherent in the process. Notwithstanding these findings the District Court held the patent "an obvious combination of old elements"

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*Emphasis ours unless otherwise noted.

because the difference between the patent in suit and the prior art "is not substantial enough to be termed invention" (App. C, pp. 15a-16a).

The Court of Appeals recognized that it was the "interaction of the grooves with the wedge plates" (App. A, p. 3a) which holds the sideboards in position, but affirmed the holding of obviousness.

REASONS FOR GRANTING THE WRIT.

I.

In *Graham v. John Deere Co.*, (1966) 383 U.S. 1, this Court examined for the first time the "non-obvious" condition of patentability made express in the patent law by Section 103 of Title 35. The Court set forth the approach to be used in applying that condition as follows (pp. 17-18):

> "Under §103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. As indicia of obviousness or nonobviousness, these inquiries may have relevancy."

Since that time the lower courts have quoted or cited the *Graham* "factual inquiries" in almost every patent case involving the application of 35 U.S.C., Section 103. However, the "strict observance of the requirements" demanded by the Court in *Graham* (p. 18) and reaffirmed in *Anderson's-Black Rock v. Pavement Co.*, (1969) 396 U. S. 57 at 62, has not followed. The lower courts have little trouble determining the scope and content of the prior art and the differences between the prior art and the claims at issue. However, seldom do the lower courts make any factual determination of the level of ordinary skill in the pertinent art.

The Court of Appeals for the Third Circuit has expressly approved the failure of trial courts to make specific findings on the factual inquiries mandated by *Graham*. In the present case it stated:

> "The district court's failure to address each part of the test with specific findings does not warrant reversal, since *Graham* does 'not require that the three primary findings be made, but rather, only that the three primary tests be considered in the findings made by the district court.' Trio Process Corp. v. L. Goldstein's Sons, Inc., 461 F.2d 66, 71 (3d Cir.), *cert. denied*, 409 U.S. 997 (1972)." [Emphasis in original]

To permit the trial court to merely "consider" in some unarticulated manner the "basic factual inquiries" mandated by this Court in the *Graham* case does not accord with this Court's admonition of strict observance of those requirements made in *Graham* and reaffirmed in *Anderson's-Black Rock, supra*. Further, it is contrary to the requirement of Rule 52(a) of the Federal Rules of Civil Procedure and unfair to a litigant and an appellate court.

II.

One reason that the lower courts have failed to make express findings on the level of ordinary skill in the art may be that the courts do not know what evidences the level of ordinary skill. This may in turn be the result of a failure to understand the significance of the term "secondary considerations" as used in *Graham*. The factors which this Court termed "secondary considerations" particularly long felt but unsolved needs and failure of others are the best if not the only satisfactory guides to the level of skill in the art. Nevertheless, many trial courts have totally ignored these important guides to the level of ordinary skill because this Court termed them "secondary." For example, in *Research Corporation v. Nasco Industries, Inc.,* (7 Cir., 1974) 501 F.2d 358, 362, the Court stated:

> "A failure to consider such secondary factors, in the face of the evident lack of difference, would not constitute reversible error. Scott Paper Co. v. Fort Howard Paper Co., 432 F.2d 1198, 1203-1204 (7 Cir. 1970)."

And in *Schwinn Bicycle Co. v. Goodyear Tire & Rubber Co.,* (9 Cir., 1970) 444 F.2d 295, 300, the Court stated:

> "Reference need be made to such secondary considerations only when the question of obviousness is uncertain and inquiry into the 'circumstances surrounding the origin of the subject matter' become of importance. We do not think there is such uncertainty here." [Footnotes omitted.]

In *Halliburton Company v. Dow Chemical Company,* (10 Cir., 1975) 514 F.2d 377, 379, the Court stated:

> "The need for consideration of secondary evidence is 'an evidentiary question primarily entrusted to the district court.' Potter Instrument Company, Inc. v. Odec Computer Systems, Inc., 1 Cir., 499 F.2d 209, 211. Lack of invention cannot be outweighed by secondary factors. Dow Chemical Co. v. Halliburton Oil Well Cementing Co., 324 U. S. 320, 330, 65 S. Ct. 647, 89 L.Ed. 973."

On the other hand, in *Timely Products Corporation v. Arron,* (2 Cir., 1975) 523 F.2d 288, 294, the Court stated:

> "In referring to such factors as 'secondary considerations' the Court surely did not intend to depreciate their importance, but only to indicate that they are to be considered *after* a preliminary determination of the precise subject matter at issue has been completed.
>
> * * * * *
>
> "We can conceive of no better way to determine whether an invention would have been obvious to persons of ordinary skill in the art at the time than to see what such persons actually did or failed to do when they were confronted with the problem in the course of their work. If the evidence shows that a number of skilled technicians actually attempted, over a substantial period, to solve the specific problem which the invention overcame and failed to do so, notwithstanding the availability of all the necessary materials, it is difficult to see how a court could conclude that the invention was 'obvious' to such persons at the time." [Emphasis in original]

An in *Jack Winter, Inc. v. Koratron Co., Inc.,* (N.D. Cal., 1974) 375 F. Supp. 1, 44, the Court stated:

"Moreover, Associate Judge Giles S. Rich of the Court of Customs and Patent Appeals has observed that the Supreme Court's use in the *Graham* opinion of the word 'secondary' was unfortunate since these factors are in fact *'circumstantial evidence of the highest probative value.'* The position of the Court of Customs and Patent Appeals is 'that such evidence must *always* be considered in connection with the determination of obviousness.' Application of Fielder, *supra*, 471 F.2d at 644 (emphasis in the original)."

And Judge Markey, Chief Judge of the Court of Customs and Patent Appeals, made the following observation in an address to the Judges Seminar conducted by the Federal Judicial Center, October 16, 1974 (66 F.R.D. 529, 537):

"One caveat—the opinion refers to 'secondary' considerations such as commercial success, long-felt need, and so on, and says these facts may be indicia of nonobviousness and thus that the invention was patentable. But these considerations are not secondary in *importance;* they are secondary only in time, because they occurred or became relevant only after the invention was made. Just as you test many acts in other cases by what happened afterwards, it is proper and important and necessary to consider commercial success, copying by others, licenses, filling of a long-felt need and similar events in patent cases. The nexus between these features of the invention environment may be weak or strong. The weight you will attach to them will vary accordingly. But these indicia should be considered before, not after, you decide the question of obviousness. There is no warrant for disregarding any probative evidence in any case, patent cases included." [Emphasis in original.]

The term "secondary considerations" has led some lower courts to disregard those considerations as secondary in importance. Those same courts make no attempt to determine the level of skill in the art. Other courts recognize the probative value of those considerations and term them secondary in point of time only. This Court should resolve this conflict. Until it does there can be no uniformity in the application of the obviousness test.

In the present case the trial court found a problem in the art so significant that it was believed inherent in the process of steelmaking. Nevertheless, the lower courts ignored this fact finding and held the differences between the prior art failures and the patented success "not substantial enough to be termed invention." The lower courts' failure to consider the level of ordinary skill in the art as evidenced by the long-standing problem has led it to the error suggested in *Plantronics, Inc. v. Roanwell Corp.,* (S.D. N.Y., 1975) 403 F. Supp. 138, 148, where the Court stated:

"Indeed, as simple as the invention now appears, it would seem presumptuous to the point of arrogance to conclude that it was 'obvious' to persons of ordinary skill in the art, notwithstanding their lengthy and unsuccessful struggle to achieve such results."

III.

In *Sakraida v. Ag Pro, Inc.,* (1976) ..... U.S. ....., 44 U.S. Law Week 4477, this Court held that a combination of old elements to produce an abrupt release of water directly on a barn floor from storage tanks or pools could not be characterized as achieving a synergistic result. The Court further held that the old elements performed the same function they had been known to perform. The Court concluded that such combinations are not patentable under the standards appropriate for a combination patent.

In *A. & P. Tea Co. v. Supermarket Corp.,* (1950) 340 U.S. 147, this Court had stated (p. 152):

> "*The conjunction or concert of known elements must contribute something; only when the whole in some way exceeds the sum of its parts is the accumulation of old devices patentable.* Elements may, of course, especially in chemistry or electronics, take on some new quality or function from being brought into concert, but this is not a usual result of uniting elements old in mechanics. This case is wanting in any unusual or surprising consequences from the unification of the elements here concerned, and there is nothing to indicate that the lower courts scrutinized the claims in the light of this rather severe test.
>
> "Neither court below has made any finding that old elements which made up this device perform any additional or different function in the combination than they perform out of it."

The suggestion that each old mechanical element perform a new function, if carried to the extreme, would make it impossible to sustain any patent for a combination of mechanical elements. A pump will always function as a pump. A gear will always function as a gear. We submit that the key to the synergistic result demanded originally in the *A. & P. Tea Co.* case, *supra,* is the "conjunction or concert of known elements" which contributes something to the art. It is the coaction of the old elements in the combination to produce a new and unexpected result which is demanded for combination patents.

In *United States v. Adams,* (1966) 383 U.S. 39, this Court made no reference to the respective functions of the old elements. It did, however, point out that the combination "is shown to embrace elements having an interdependent functional relationship" which gave an unexpected result.

In the present case the court below found that the "coaction" or "interaction" of old elements solved a problem which existed for such a long time that it was believed to be inherent in steelmaking. This we submit is a synergistic result which meets the standards for combination patents. This Court should clearly state that it is the coaction or "conjunction or concert of known elements" in a combination producing a new result that is the controlling factor for patentability. Inventors, investors, the patent bar and the public need and deserve guidance from this Court.

CONCLUSION.

This writ should be granted (1) to obtain consistency and actual findings on the level of ordinary skill in the art, (2) to eliminate the conflict in the lower courts regarding the meaning and significance of the so-called "secondary considerations" and (3) to clarify the impact of a synergistic result on a combination patent.

Respectfully submitted,

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APPENDIX A

Opinion of the Court of Appeals
[filed March 8, 1976]

UNITED STATES COURT OF APPEALS
FOR THE THIRD CIRCUIT

NO. 75-1875

METALLURGICAL EXOPRODUCTS CORPORATION,
Appellant
v.
PITTSBURGH METALS PURIFYING COMPANY, INC.

On Appeal from the United States District Court
for the Western District of Pennsylvania
Civil Action No. 74-471

Argued January 8, 1976

Before: VAN DUSEN, ADAMS and WEIS, *Circuit Judges.*

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Opinion of the Court

(Filed March 8, 1976)

ADAMS, *Circuit Judge.*

One of the intermediate steps in the processing of steel is the pouring of the molten metal into molds to

form ingots that are subsequently melted again for use in the next stage in the procedure. A patent covering a device designed to enhance the quality of the ingots so fashioned was declared invalid by the district court, and we are now asked to review that determination.

A.

When molten steel is poured into ingot molds, solidification begins adjacent to the walls of the mold and proceeds inward. Because the steel contracts as it sets, a central cavity known as a pipe frequently forms inside the ingot. Any portion of an ingot with a pipe in it has limited value and is scrapped.

To cope with the problem of piping, steelmakers have long employed mechanisms called hot tops. When affixed to the ingot mold, a hot top keeps the steel at the top of the mold hot. The still molten steel flows from the top of the mold into any space formed in the ingot, so that the completed ingot will have no pipe.

Following the industry's unsuccessful experience with the first generation of hot tops, systems were developed which consisted of two sideboards suspended on the long sides of the rectangular mold. They often suffered from a major defect: The upward force created by the rising of the molten steel as it was poured into the ingot mold caused the sideboards to float away from their intended position. When floating occurs, the hot top cannot perform its function. As a result, a pipe is created.

Various devices have been utilized over the years in attempts to solve the floating problem. For example, U-shaped clips have been placed over the sideboards

and the wall of the mold, and turnbuckles and rods have been spread between the facing sideboards. Subsequently, hot top systems with four sideboards, one adjacent to each wall of the mold, were developed. The device with four sideboards utilizes springclips and wedges in the corners of the mold, where two sideboards meet. A later innovation in the four-wall system was the placing of wedging springs across each of the four corners, their ends implanted in parallel vertical grooves. The grooves are near the end of each sideboard, and their depths decrease in order to create a converging effect.

Metallurgical Exoproducts Corporation (MEC) endeavored to develop a new approach to the difficulties caused by floating sideboards. Its system, conceived by William Koch, then an MEC salesman, consists of four sideboards. Near the ends of each sideboard are grooves that are directed downwardly and toward the end of the board. The result is that the two grooves in each corner, one from each of the two boards comprising the corner, converge toward each other and form a truncated "V." A metal wedge plate is then inserted in the converging grooves, which have a uniform depth, at each corner of the mold. The interaction of the grooves with the wedge plates, which expand and tighten the sideboards when heated, serves to hold the sideboards in a fixed position. The ensuing reduction in floating decreases the incidence of pipe information within the ingots.

Koch filed for a patent to cover his system in 1967, and a patent was issued to him as U. S. Patent Number 3,421,731. The Koch patent was immediately assigned to MEC, and has been owned by MEC ever since. In 1973, four and a half years after the issuance of the

Koch patent, MEC filed suit against PMP, alleging that PMP was infringing by making, using, and selling a hot top system within the scope of patent 3,421,731. PMP asserted in its answer that (1) the Koch patent is invalid and (2) even if it is valid, it was not infringed by PMP.[1]

The district court held the Koch patent invalid, ruling that it was a development obvious to someone having ordinary skill in the art.[2] In view of its disposition of the case in that manner, the district court did not rule whether PMP had infringed.

MEC has appealed from the judgment of the district court. We affirm on the ground that the district court did not err in holding the patent invalid for obviousness.

B.

MEC urges that the district court applied an incorrect standard in determining whether the patented system was obvious to one reasonably skilled in the art. A proper application of the test set out in *Graham v. John Deere Co.,* 383 U.S. 1 (1966), and *United States v. Adams,* 383 U.S. 39 (1966), MEC maintains, would necessarily lead to a ruling that the Koch patent is valid. MEC also asserts that PMP infringed its patent. Recognizing that although a remand may seem appropriate prior to any determination of infringement, if

1. A counterclaim by PMP, alleging that MEC had infringed PMP's patent number 3,261,058, was dismissed by agreement of the parties.

2. 35 U.S.C. §103 (1970).

that question is reached by this Court, MEC suggests that the infringement question may be answered without a remand on the basis of documentary and physical exhibits and undisputed testimony in the record.

In support of the favorable judgment it received in the district court, PMP proffers four contentions: (1) the Koch patent does not represent an advance from the prior art sufficient to support patent validity and the district court's findings to that effect cannot be overturned; (2) the failure of the Patent Office to consider pertinent prior art precludes MEC from relying on the presumption of validity that normally attaches to a patent; (3) the Koch mechanism did not enjoy commercial success and such success, event if there was any, is not determinative of the validity of the patent; and (4) PMP has not infringed in any event.

C.

The rule that a development obvious to a practitioner in the art may not be patented is contained in section 103 of the Patent Act. A patent may not be granted, that section provides, "if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains."[3] The contours of the obviousness standard were surveyed by the Supreme Court in its 1966 *Graham* decision.[4]

3. 35 U.S.C. §103 (1970).

4. Graham v. John Deere Co., 383 U.S. 1 (1966) *See also* United States v. Adams, 383 U.S. 39 (1966).

Establishing what is by now basic knowledge to all patent attorneys, the Court ruled that three inquiries must be made to assess whether the obviousness standard is met: "the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art [is to be] resolved."[5] Although the "ultimate question of patent validity is one of law," the three preliminary inquiries are factual in nature.[6] The commercial success of the subject matter and the failure of others to solve long felt needs may be relevant to patent validity, but are not dispositive.[7]

Following the guidance given in *Graham,* the district court noted and seems to have considered the appropriate tests.[8] It described the prior art primarily in terms of two particular hot top maintaining systems. The first, owned by PMP, includes two sideboards with vertical parallel grooves having tapered bottoms. Wedging turnbuckles or wedging springs are placed in opposing grooves, restraining the sideboards. The second system

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5. Graham v. John Deere Co., *supra* at 17.

6. *Id.*

7. *Id.* at 17-18. *Accord* Anderson's-Black Rock, Inc. v. Pavement Salvage Co., 396 U.S. 57, 61 (1969); Great Atlantic & Pacific Tea Co. v. Supermarket Equip. Corp., 340 U.S. 147, 153 (1950).

8. The district court's failure to address each part of the test with specific findings does not warrant reversal, since *Graham* does "not require that the three primary findings be made, but rather, only that the three primary tests be considered in the findings made by the district court." Trio Process Corp. v. L. Goldstein's Sons, Inc., 461 F.2d 66, 71 (3d Cir.), *cert. denied,* 409 U.S. 997 (1972).

that the district court found representative of the prior art was devised by Blaine Helmer, PMP's expert witness. It consists of four sideboards with vertical grooves near the corners of the ingot mold. In the Helmer system, wedging springs are used in each corner to keep the sideboards in a fixed position.

In evaluating the differences between the prior art and the Koch device, the district court appears to have credited the testimony of Helmer to the effect that there is no real difference between his mechanism and the Koch system. On the basis of its findings, the district court ruled the Koch patent invalid for obviousness.

The findings of fact made by the district court are not clearly erroneous.[9] They indicate that there are only two apparent differences between the Koch and Helmer systems. The former system utilizes nonparallel angled grooves to hold wedge plates in place; the latter employs parallel vertical grooves to secure wedging springs. But it is apparent that the mechanisms use virtually identical approaches to solve the floating problem presented when hot tops are not held firmly in place. In light of the similarity, we cannot say that the district court was incorrect in determining that the patent is invalid on the ground of obviousness.[10]

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9. Fed. R. Civ. P. 52(a).

10. Our disposition of the matter makes unnecessary an evaluation of the charge that PMP infringed the Koch patent.

Appendix A.

D.

Accordingly, the judgment of the district court will be affirmed.

TO THE CLERK:

Please file the foregoing opinion.

ARLIN M. ADAMS
Circuit Judge

DATED:

Appendix B.

APPENDIX B

Judgment of the Court of Appeals
[Entered March 8, 1976]

United States Court of Appeals
for the Third Circuit

NO. 75-1875

METALLURGICAL EXOPRODUCTS CORPORATION,
Appellant
vs.
PITTSBURGH METALS PURIFYING COMPANY, INC.

(D.C. Civil Action No. 74-471)

ON APPEAL FROM
THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF PENNSYLVANIA

Present: VAN DUSEN, ADAMS and WEIS, *Circuit Judges*

Judgment

This cause came on to be heard on the record from the United States District Court for the Western District of Pennsylvania and was argued by counsel.

On consideration whereof, it is now here ordered and adjudged by this Court that the judgment of the said District Court, filed May 30, 1975, be, and the same is hereby affirmed. Costs taxed against the appellant.

ATTEST:

THOMAS P. QUINN
Clerk

March 8, 1976

APPENDIX C

Opinion and Order of the District Court
[Filed May 30, 1975]

IN THE
UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF PENNSYLVANIA

METALLURGICAL EXOPRODUCTS CORPORATION v. PITTSBURGH METALS PURIFYING COMPANY, INC.	Civil Action No. 73-471

Opinion

WALLACE S. GOURLEY, Senior Judge:

This is a patent infringement proceeding filed by plaintiff and with jurisdiction existing pursuant to 28 U.S.C.A. §1338(a). The Court has afforded the parties a full and complete trial and has considered the briefs and argument of counsel. Based thereon, it is the considered judgment of the Court that no basis exists for concluding that there has been any infringement by defendant to plaintiff's patent, Patent No. 3,421,731, issued by the United States Patent Office on January 14, 1969. The Court has arrived at this determination after concluding that plaintiff's patent was invalid, lacking non-obviousness as a matter of law.

The facts may be briefly stated. William H. Koch and George Rocher secured the patent which is the subject of the instant suit by application filed September 1, 1967. The patent involves a Hot Top Maintaining System and shall hereinafter be referred to as the "Koch et al. patent." Plaintiff felt that Claims 1, 3, and 7 of said

patent had been infringed by defendant, and said Claims read as follows:

> "1. A hot top for an ingot mold and the like, said hot top comprising a plurality of end adjacent preformed elongated sideboards, means for suspending said sideboards adjacent corresponding wall surfaces of said ingot mold, each of said sideboards having a pair of downwardly and outwardly inclined grooves formed on the inward face thereof and disposed near the ends thereof respectively, whereby the inclination of each pair of grooves on respectively adjacent end portion of said sideboards have a downward convergency, and means insertable into each of said pairs of adjacent grooves and movable therealong to points of bearing contact with said sideboards adjacent the lower edges thereof for restraining said sideboards flushly against said wall surfaces and for engaging forcefully at least portions of said sideboards adjacent said edges with said wall surfaces to prevent said sideboards from floating when said ingot is poured into said mold.
>
> "3. The combination according to claim 1 wherein said restraining and engaging means include a number of wedge plates, each of said plates being so shaped that insertion of said plates into respective pairs of said adjacent grooves and movement therealong causes increasing forces to be applied to the associated sideboards to press at least the lower edges of said sideboards into close fitting engagement with said mold.
>
> "7. The combination according to claim 3 wherein each of said wedge plates are provided with opposed

inclined edges, the inclination of said edges being slightly less than the inclination of said grooves so that said forces are concentrated adjacent the lower ends of said grooves and the lower edges of said sideboards."

It is sufficient for our purposes to know that in the art of steelmaking, the molten steel is poured into an ingot mold to solidify. It is during this solidifying or cooling-off period the ingot tends to contract, forming a central cavity or "piping" within the ingot. When a central cavity is found within the ingot, the steel is not considered useable. To eliminate this piping, thus obtaining as much usuable steel as possible, steelmakers have employed the use of "hot tops." The purpose of a hot top is to maintain the steel molten at the upper end of the ingot mold so that it can flow inwardly and downwardly to fill the central cavity.

Since the early 1900's, hot tops of various sizes and forms have been used in the steel industry. Early hot tops were large, integral four-sided structures that were placed either on top or inside the top of an ingot mold. Later, hot tops comprising two sideboards were used. Presently, the trend is to use hot tops comprising four sideboards.

It was found that if a sideboard was not securely held against the wall of the ingot mold, it would float due to the buoyancy force of the molten metal as the metal rises in the mold during the pour. When this occurs, the hot top system is unable to perform its desired function of eliminating the piping, or central cavity.

To resolve this problem of the floating sideboards, plaintiff developed via its Kotch et al patent a ridged Hot Top Maintaining System based on the coaction between inclined, converging grooves in the sideboards and wedge plates. More specifically, the system includes four sideboards having means, such as hangars, for suspending them from the top of an ingot mold wall. Each of the boards has a pair of downwardly and outwardly inclined grooves in it. When the sideboards are installed in the ingot mold, the grooves on the ends of the adjacent sideboards have a downwardly convergency. A metal wedge plate is inserted into the grooves at each of the corners of the mold. It is the coaction between the grooves and the wedges which prevents the sideboards from floating. Furthermore, the wedges tend to expand and hence tighten the sideboards at increased temperature.

It is the considered opinion of this Court that the patent in question, the Kotch et al. patent, is invalid; and thus there is no infringement by the defendant. Plaintiff's patent is invalid because, in the words of the statute 35 U.S.C. §103:

". . . the difference between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains."

Although the ultimate question of obviousness is one of law, the issue can best be determined in light of three basic factual inquiries: (1) scope and content of the prior art; (2) the differences between the prior art and the claims at issue; and (3) level of ordinary skill

in the pertinent art. It is after careful consideration of these three factors that the Court makes its determination that plaintiff's invention lacked "unobviousness." *Graham v. John Deere Co.,* 383 U.S. 1 (1966).

The law is quite clear that the presumption of the validity of a patent may be strengthened where the Patent Office has granted it with knowledge of relevant prior art, but the law is equally clear that the presumption of validity is weakened upon a showing of pertinent prior art not considered by the Patent Office. *Gaddis v. Calgon Corporation,* 506 F.2d 880 (5th Cir., 1975). Quite often pertinent prior art is not considered due to the fact that the Patent Office is too overworked to give adequate attention to patent applications and grants.

One year prior to plaintiff ever filing his application for the patent in question, defendant was issued a patent, Patent No. 3,261,058, hereinafter referred to as the "Tisdale patent." The purpose of defendant's patent was to prevent piping within the ingot mold. The Tisdale patent employed the use of vertically paralled grooves with tapered bottoms. The trend in the steel industry at the time of the development of this patent was to use two long opposed sideboards without end sideboards. To restrain the sideboards against the mold, either a wedging turnbuckle or wedging spring was employed to move along the tapered bottoms of grooves in the sideboards.

At the time of trial, defendant's expert witness, Blaine R. Helmer, testified that several years before the conception of the Kotch et al. patent, he devised, used and sold four-sided systems having downwardly extending grooves adjacent to the side edges of each of the sideboards. He applied restraining means in the

form of wedging springs to the lower portion of the grooves of end adjacent sideboards at each of the four corners of the mold to keep the sideboards firmly against the mold during the pouring process. Helmer further testified that it would have been obvious at the time of the Kotch et al. patent to use well known wedge plates, instead of Helmer's springs, as the restraining means and have them fit correspondingly shaped grooves in the sideboards.

The law is clear that no presumption of validity will be awarded to a patent where there is evidence that the Patent Office has been misled as to the true import of prior art references. *Kahn v. Dynamics Corporation of America,* 508 F.2d 939 (2nd Cir., 1975). It is the considered opinion of this Court that no presumption of validity shall be accorded to plaintiff's Kotch et al. patent because plaintiff had misled the Patent Office as to the inoperability of the Witt patent. Likewise, the Patent Office was not informed at the time of considering plaintiff's application of the prior public uses of defendant testified to by Helmer and Tisdale and the prior public use of parallel grooves testified to by Rocher.

Furthermore, while the Kotch et al. patent solved problems that were "basic" in the sense that they had persisted for a long time and thus seemed to be inherent in the process of steelmaking, in the final analysis, plaintiff's invention was merely an obvious combination of old elements. While such secondary considerations as commercial success and long-felt but unresolved needs in the field constitute relevant evidence in a close case on the issue of obviousness, once it is established by prior art references that the difference between the patents in suit and the prior art is not substantial

enough to be termed invention, the patent cannot be sustained. Combinations of old elements may be patentable, but such is not the case here.

We now come to the issue of whether defendant, Pittsburgh Metals Purifying Company, Inc., is entitled to an award of reasonable attorneys' fees under 35 U.S.C. §285. In cases where the Court is convinced that the patent in suit is so wholly devoid of substance that the plaintiff could not have had a bona fide belief in its validity, only then shall it award the defendant reasonable attorneys' fees. *Indiana General Corp. v. Krystinel Corporation,* 421 F.2d 1023 (2nd Cir., 1970). Notwithstanding that the plaintiff's patent has been determined invalid on grounds of unobviousness, it cannot be said that plaintiff's process was wholly devoid of substance. On the contrary, plaintiff's process resolved a long standing problem in the steel industry. Therefore, although plaintiff was not an inventor, plaintiff was an originator; and as such, defendant is not entitled to attorneys' fees.

Findings of fact and conclusions of law have not been separately stated but are included in the body of the foregoing opinion as specifically authorized by Rule 52(a) of the Federal Rules of Civil Procedure.

An appropriate Order is entered.

Order

AND NOW, this 30 day of May, 1975, judgment is hereby entered in favor of defendant, Pittsburgh Metals Purifying Company, Inc., and against plaintiff, Metallurgical Exoproducts Corporation. Defendant's request for attorneys' fees is hereby denied.

WALLACE S. GOURLEY, S.J.
Senior District Judge

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Jan. 14, 1969 W. H. KOCH ET AL 3,421,731

HOT TOP MAINTAINING SYSTEM

Filed Sept. 1, 1967 Sheet 1 of 2

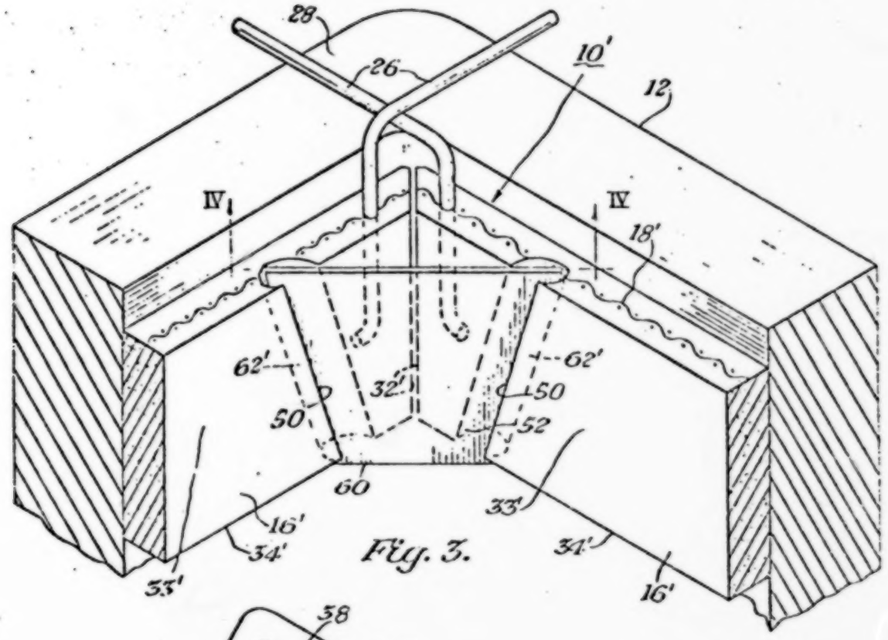

Fig. 3.

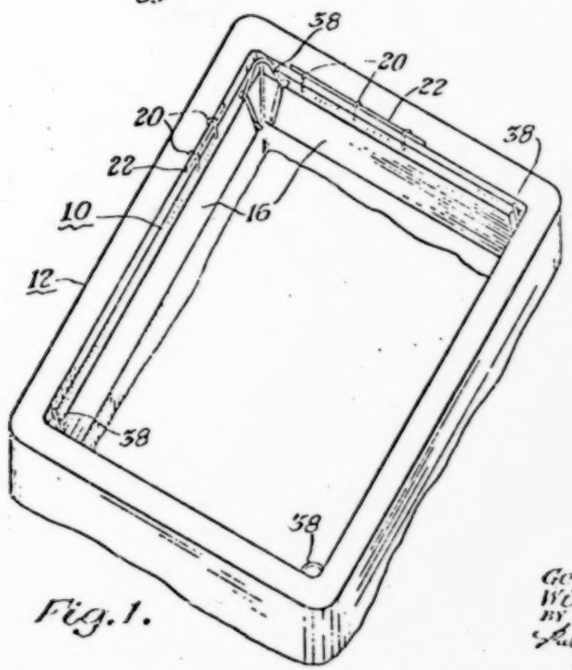

Fig. 1.

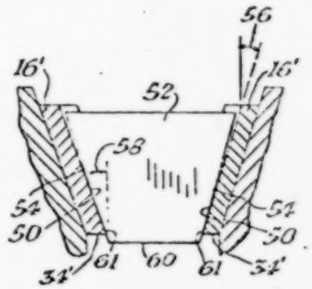

Fig. 4.

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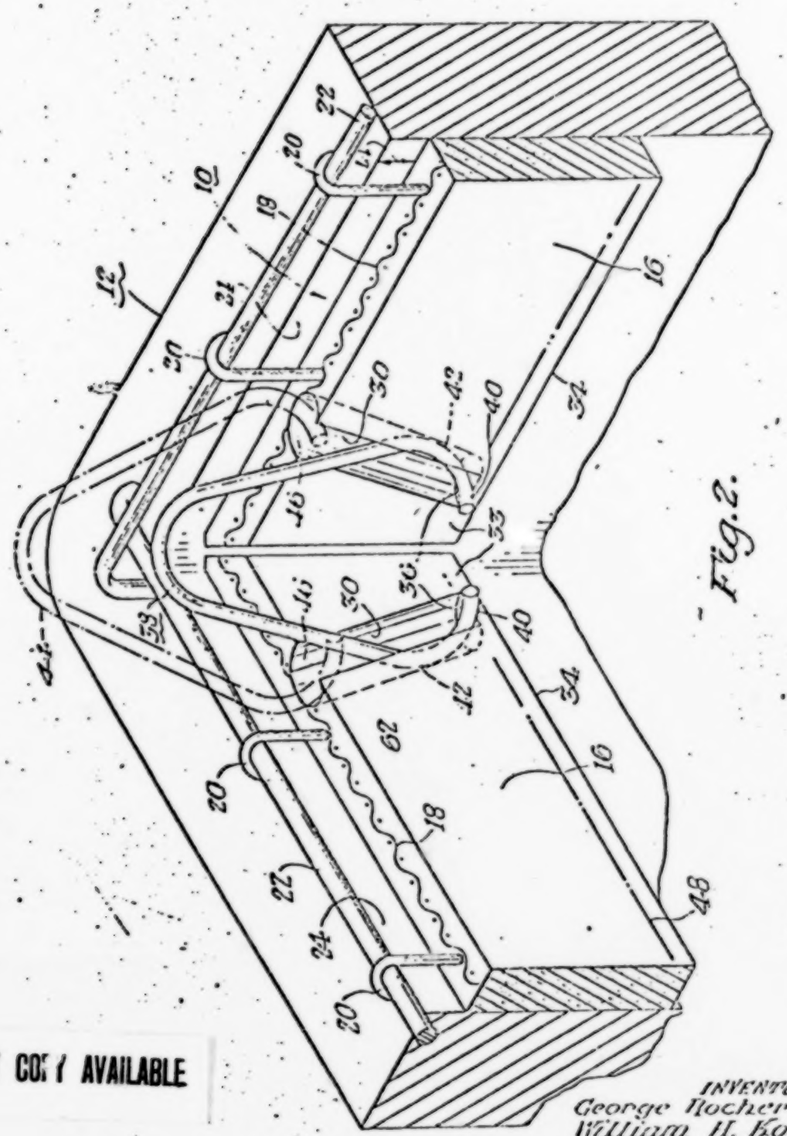

Fig. 2.

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Appendix D.

UNITED STATES PATENT OFFICE
3,421,731
Patented Jan. 14, 1969

3,421,731

Hot Top Maintaining System

William Henry Koch, Trenton, Mich., and George [illegible]ocher, Pittsburgh, Pa., assignors to Metallurgical Exo-products Corporation, McKees Rocks, Pa.

Filed Sept. 1, 1967, Ser. No. 665,081
U.S. Cl. 249—197 7 Claims
Int. Cl. B22d 7/10

ABSTRACT OF THE DISCLOSURE

A hot top maintaining system is disclosed for suspending preformed hot top elements or sideboards within an ingot mold and for restraining the sideboards against the inner surfaces of the mold to prevent molten liquid steel or other molten ingot material from rising between the sideboards and the mold. With this arrangement "floaters" are avoided. The restraining means include a number of spring hooks, or alternatively wedge plates, which are inserted into respective pairs of inclined grooves formed on the inward faces of the sideboards, adjacent their ends, respectively.

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The present invention relates to a hot top for an ingot mold or the like and to means for fabricating, installing and maintaining preformed hot top members within the mold structure. More particularly, the invention pertains to a hot top construction for relatively large ingot molds and having preformed components which are not subject to floating.

Although, the hot top of the invention is applicable to ingot molds for other types of ingot material, the hot top is especially useful in the art of steelmaking and thus will be described mainly in his applicational background. Functionally, the hot top furnishes a source of heat and thermal insulation at the upper portions of the ingot mold structure. For this reason the hot top is usually fabricated from an exothermic insulating material. There are many forms of exothermic materials known to the industry. For the most part exothermic materials for the most include ferrous oxide and free aluminum which react at temperatures above 1000° F. to form aluminum oxide with release of considerable heat. These chemical reactions are of course well known and are readily initiated when the hot top is contacted by molten steel, the melting point of which is 2700° F.

As the ingot cools and hardens within the mold structure, the hot top is so positioned therewithin to apply considerable heat to the upper end of the ingot while the remainder of the ingot progressively cools and solidifies. Heating the hot top portion of the ingot is essential in order to maintain the steel in a molten condition at the top of the ingot. Thus, molten steel from the ingot top can flow inwardly and downwardly to fill the central cavity which tends to form within the ingot as a result of shrinkage during its solidification.

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Although the hot top is expendable and must be renewed with each pour, it is extremely important to fit the hot top properly within the upper region of the mold structure. Maintaining a proper fit prevents the molten steel from rising between the hot top and the mold as the level of the steel rises within the mold structure. The presence of molten steel between the hot top components and the adjacent wall surfaces of the mold permits the hot top components to become freely contacted by the liquid steel whereupon the hot top components are able to float by virtue of Archimedes' principle. If there is no liquid steel between the adjacent wall and the sideboards or similar components of the hot top there is no tendency to float.

It is customary to fabricate hot tops from easily molded and handled components or sideboards of essentially flat or linear construction which conform to the generally rectangular ingot molds in use at the present time. The sideboards usually are molded about a reinforcing wire mesh and various types of hanger wires, or rods such as Z-bars, are molded within the sideboards. By means of such wires or rods the sideboards are suspended from the upper edges of the mold structure or from pipes or rods laid along the inside upper edges of the mold. With the sideboards thus suspended, a problem arises in maintaining the lower edges of the sideboards in close-fitting engagement with the adjacent inner mold surfaces to prevent the liquid steel or other molten material from rising therebetween.

In some applications, the tendency of the hot top to float can be prevented by utilizing a one-piece closely fitted hot top to prevent the molten steel from rising behind the hot top and the ingot mold wall. A one-piece

closely fitting hot top, however, is impractical particularly in the case of the larger ingot molds, owing to the fragility of the exothermic or insulating material, the difficulties of prefabricating and handling, manufacturing tolerances, and the likelihood of buckling when the continuous hot top is fitted within a mold which is hot from a previous pour.

Many proposals have been advanced for the purpose of preventing liquid steel from rising between the hot top and the adjacent mold surfaces. Such proposals involve additional structural components such as wiper strips which are attached to the hot top but which usually melt before the molten steel can rise above the lower inner surfaces of the sideboards and press the sideboards against the mold surfaces. Examples of such sealing means are disclosed by Charman et al., U.S. Patent No. 1,804,207 and Urmetz, U.S. Patent No. 2,300,077.

Other previously proposed hot tops involve complicated means for suspending or retaining hot top components in the top portion of the ingot mold. Such suspending or retaining means as typified by Nicholas, U.S. Patent No. 2,272,018, Gathmann et al., No. 1,501,655 and Marburg, No. 2,914,825, are not reliable for many applications and do not eliminate the possibility of floaters. Moreover, these prior hot tops involved complicated structural shapes which cannot be readily molded within the hot top sideboards by conventional techniques.

We overcome these disadvantages of the prior art by providing a unique hot top construction which can be assembled from prefabricated components of readily variable sizes. Our novel hot top construction and our novel means of fabricating and installing the same posi-

tively prevents molten steel from rising behind and floating the hot top. Our hot top is quickly and easily installed by suspension of the hot top components from the upper edges of the mold structure. For this purpose simple hanger rods or wires are employed, which are readily molded within the sideboards when the latter are preformed. Quickly installed means are then used to maintain the sideboards tightly against the inner mold surfaces.

In a typical application our novel hot top structure includes a plurality of premolded or otherwise preformed sideboards which are suspended adjacent the inner wall surfaces of the ingot mold. Each of the sideboard members is provided with a pair of angularly disposed grooves formed on its inward face and adjacent its ends respectively. After the sideboards are installed, restraining means are inserted into a pair of such grooves adjacent each corner of the mold. The retaining means are positioned within the associated pair of grooves to apply a maximum retaining force adjacent the lower ends of the grooves for the purpose of forcefully engaging the lower edge of the sideboards with the mold structure. Means are associated with the restraining members or with the grooves or both for the purpose of maximizing the restraining forces adjacent the lower edges of the sideboards.

Although the restraining means can be made of steel and therefore melted when molten steel is poured, the restraining means are still able to hold the sideboards lightly in place as described above, until the level of the liquid steel rises above the downward edges of the sideboards, and whereupon the weight of the steel presses or restrains the sideboards tightly to the mold surfaces. When this occurs the sideboards, of course, likewise cannot be floated, as the pressure of liquid steel

on the inward faces of the sideboards prevents the steel from rising behind the sideboards.

We accomplish these desirable results by providing a hot top for an ingot mold and the like, said hot top comprising a plurality of preformed elongated sideboards suspendable adjacent corresponding wall surfaces of said ingot mold, each of said sideboards having a pair of inclined grooves formed on the inward face thereof and disposed adjacent the ends thereof respectively, the inclination of each pair of adjacent grooves on respectively adjacent end portions of said sideboards having a downward convergency when said sideboards are so suspended, restraining means insertable into each pair of adjacent grooves and movable therealong to points of bearing contact with said sideboards adjacent the lower edges thereof to engage forcefully said edges with the adjacent surfaces of said mold when said sideboards are so suspended.

We also desirably provide a similar hot top wherein restraining means include a number of wedge plates, each of said plates being so shaped that insertion of said plates into respective pairs of said adjacent grooves and movement therealong causes increasing forces to be applied to the associated sideboards to press at least the lower edges of said sideboards into close fitting engagement with said mold.

We also desirably provide a similar hot top wherein each of said wedge plates is provided with opposed inclined edges, the inclination of said edges being slightly less than the inclination of said grooves so that said forces are concentrated adjacent the lower ends of said grooves and the lower edges of said sideboards.

We also desirably provide a similiar hot top wherein said restraining means include a number of spring hooks of generally U- or V-shaped configuration, said hooks being so shaped that they are increasingly compressed as they are moved along said pairs of grooves, respectively.

We also desirably provide a similar hot top wherein a stop member is formed at the lower end of each of said grooves and adjacent the lower edge of the associated one of said sideboards to limit the downward movement of said spring hooks.

During the foregoing discussion, various objects, features and advantages of the invention have been set forth. These and other objects, features and advantages of the invention have been set forth. These and other objects, features and advantages of the invention together with structural details thereof will be elaborated upon during the forthcoming description of certain presently preferred embodiments of the invention and presently preferred methods of practicing the same.

In the accompanying drawings, I have shown certain presently preferred embodiments of the invention and have illustrated certain presently preferred methods of practicing the same, wherein:

FIGURE 1 is an isometric view illustrating the top portion of an ingot mold and showing one arrangement of our novel hot top positioned in the upper portion of the mold structure;

FIGURE 2 is an enlarged, partial, isometric view of the structure shown in FIGURE 1 and illustrating one arrangement of the sideboard restraining means;

FIGURE 3 is a similar view showing another arrangement of the sideboard restraining means; and

FIGURE 4 is a partial cross sectional view of the apparatus shown in FIGURE 3, as taken along reference line IV—IV thereof, including the plane of the restraining wedge 52.

Referring now to FIGURES 1 and 2 of the drawings the hot top 10 of our invention is arranged for insertion within the upper open end of a mold structure 12. Desirably, the hot top 10 is placed so that the upper edges thereof are depressed slightly below the adjacent upper edges of the mold structure 12 as denoted by dimensional arrow 14.

In an exemplary application the hot top 10 includes four generally linear and flat sideboards 16 as better shown in FIGURE 1. Each of the sideboards 16 is prefabricated in accordance with conventional techniques, as by molding and sintering from a powdered or particulate insulating and exothermic material. For pouring steel ingots, the sideboards 16 desirably include an exothermic material containing ferrous oxide and metallic aluminum. Instead of sintering the exothermic material, the latter can be mixed with a pre-setting binder such as formaldehyde resins, which are conventionally used in foundries in connection with the so-called hot box process. When the exothermic material is contacted by the rising steel and reaches a temperature of about 1000° F. the following reaction takes place: $3FeO+2Al \rightarrow Al_2O_3+3Fe+\triangle$. This reaction evolves considerable heat and the material may reach a temperature of about 4000° F.

Each of the sideboards 16 is preferably molded about a wire reinforcing mesh 18 and one or more hanger

wires 20 are partially imbedded in the sideboards 16 when molded. The hangers 20 can be bent about supporting pipes or rods 22 laid along the upper inner edges 24 of the mold structure to suspend the sideboards 16 therewithin. Alternatively, the sideboards 16 (as sideboards 16′ in FIGURE 3) can be provided with a Z-bar 26 similarly imbedded in each end portion of the sideboards during the molding process, as better shown in FIGURE 3 of the drawings. The Z-bars 26 likewise suspend the sideboards 16′ from the upper surface of the mold structure 12.

Referring again to FIGURES 1 and 2 of the drawings, each of the sideboards 16 is provided with an inclined groove 30 adjacent each of its ends 32. The grooves 30 are formed on the inward faces 33 of the sideboards 16. A pair of such grooves 30 are thus disposed at each corner of the mold structure as shown in FIGURE 1. The inclination of each pair of grooves 30 is such that they exhibit a downward convergency, as better seen from FIGURE 2. In this example, each of the grooves 30 is terminated short of the lower edge 34 of the associated sideboard 16 to form an integrally molded stop 36.

It will be seen from the description at this point that the sideboards 16 are suspended from the top edges of the mold 12 by means of hanger wires 20 (FIGURE 2) or Z-bars 26 (FIGURE 3). However, unless some means are provided for pressing those portions of the sideboards 16 adjacent their lower edges 34 into positive, close-fitting engagement with the adjacent inner surfaces of the mold structure 12, the sideboards 16 will float, when liquid steel or other molten ingot material rises between the sideboards 16 and the adjacent mold surfaces.

We eliminate such tendency to float by providing restraining means acting in cooperation with the grooves 30 for urging the lower edge portions 34 of the sideboards into close fitting engagement with the adjacent mold surfaces. One arrangement of such restraining means as shown in FIGURES 1 and 2, includes a spring hook 38 of inverted V- or U-shaped configuration insertable into each pair of adjacent grooves 30. The lower end portions 40 of the hook 38 are bent inwardly as shown in FIGURE 2 to provide smooth leg surfaces 42 for engaging each pair of the grooves 30. Desirably, the hooks 38 are fabricated from a spring steel wire which for a typical hot top application may be about ¼ inch in diameter.

In the relaxed position of the hook 38, as denoted by its chain outline 44 in FIGURE 2, the lower ends 40 of the hooks can be readily inserted into the upper ends 46 of the grooves 30, i.e., at the widest separation between each pair of grooves 30. The hooks 38 are then forced downwardly to its solid outline position in FIGURE 2 until further downward movement is terminated by engagement of the hook surfaces 42 with the groove stops 36, respectively. The groove engaging leg surfaces 42 of the hook 38 are now adjacent the closest separation of the grooves 30 and are also closely adjacent the lower edges 34 of the associated sideboards 16. Thus, the resultant, maximum forces exerted by the hooks 38 at the sideboard grooves 30 is directed toward the sideboard lower edge portions 34 to cause these portions to forcefully engage the adjacent surfaces of the mold structure 12 and to restrain the sideboards against floating when the ingot is poured into the mold. Accordingly, it is impossible for liquid steel or other molten

ingot material to rise behind the sideboards 16 and to float the sideboards.

When the ingot material is molten steel the spring hooks 38 will of course be melted when contacted thereby. However, at such times the spring hooks 38 have already served their function as the then rising level of the liquid steel, as denoted by the reference line 48, is sufficiently above the lower sideboard edges 34 so that the sideboards 16 continue to be pressed into engagement with the mold structure 12. With the arrangement as thus described the spring hooks 38 can be easily inserted into the grooves 30 from the top of the mold structure 12 and without prior bending and compressing and readily pushed downward either manually or by tapping with a hammer or mallet. As a result the camming action or inclined plane action of the grooves 30 performs the major proportion of the effort in compressing and mounting the spring hooks 38. The use of the stops 36 (although not essential to the invention, as the open-bottomed grooves 50 of FIGURE 3 can be employed instead) eliminates any possibility of operator error in properly locating the hooks 38 including their groove engaging portions 42.

Referring now to FIGURES 3 and 4 of the drawings, another modification of our novel hot top arrangement is disclosed therein. The hot top 10′ includes the aforementioned sideboards 16′ provided with Z-bars 26. Each of the sideboards 16′ are provided with a pair of grooves 50 adjacent their ends 32′. The inclination and location of the grooves 50 are similar to the grooves 30 of FIGURE 2 with the exception that the lower stops 36 of FIGURE 2 are omitted and the grooves 50 open onto the bottom edges 34′ of the sideboards.

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Cooperating with each pair of the grooves 50 is another form of our sideboard restraining means which include in this example a number of wedge plates 52, the configuration of which is better shown in FIGURE 4. The opposed and inclined sides 54 of each wedge plate 52 are shaped so that increasing force is exerted upon the sideboards including their lower edge portions as the wedge plates are moved downwardly along the grooves 50. Desirably, the inclined edges or sides 54 are provided with a slightly lesser angle of inclination relative to the inclination (FIGURE 4) of the associated grooves 50 to concentrate the forces exerted upon the sideboards 16′ adjacent their lower edges 34′. For example each groove 50 may have an inclination of 11° to the verticle as denoted by arrow 56 while each wedge side may have an inclination of 10 to 10½° as denoted by dimensional arrow 58. It will be understood of course that the aforesaid inclination angles are exemplary and that other angles of inclination may be employed as long as the angle of inclination of the grooves 50 is somewhat greater than that of the wedge plate 52.

The wedge members 52 are inserted from the top of the mold structure 12 until their inclined edges 54 bearingly engage the bottoms of the grooves 50, or until the difference in their inclined edge inclination, (when used) relative to the inclination of the grooves 50 causes the inclined edges 54 of the wedge plate 52 to bearingly engage only lower end areas 59 of the grooves 50, as better shown in FIGURE 4. Each wedge plate 52 is then pushed manually downward or lightly tapped in this direction by a hammer or a mallet until the resulting further downward movement of the wedge plates 52 impose the desired restraining forces upon the lower edge portions 34′ of the sideboards 16′. To prevent gouging the lower portions of the grooves 50, the lower corners of the wedge plates 52 can be rounded off (not shown). Alternatively, the lower edge 60 of each wedge plate 52 desirably be made slightly shorter than the narrowest separation between the bottom surfaces of the grooves 50 at the lower ends 61 so that the lower edge 60 of each plate 52 projects downwardly of the sideboards 16′, as also better shown in FIGURE 4.

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As shown in FIGURES 2 and 3, at least the outward wall surfaces 62 or 62′ of each pair of the grooves 30 or 50 are disposed generally parallel to the plane of the associated hook 38 or wedge plate 52 when inserted therein to and in retaining the hook or plate within the grooves 30 or 50, respectively.

From the foregoing it will be apparent that novel and efficient forms of hot tops have been disclosed herein. The hot top 10 or 10′ or equivalents thereof result in the application of sufficient restraining forces to the lower edge portions 34 or 34′ of the sideboards 16 or 16′ to prevent liquid steel or other molten ingot material from rising between the sideboards and the adjacent surfaces of the mold structure. In the case of molten steel, neither the spring hooks 38 nor the wedge plates 52 are melted to release the restraining forces until the molten steel has risen sufficiently so that its own weight in turn restrains the sideboards 16 or 16′ against the mold structure.

While we have shown presently preferred embodiments of the invention and have illustrated presently preferred methods of practicing the same, it is to be distinctly understood that the invention is not limited thereto but may be variously embodied and practiced within the scope of the following claims.

We claim:

1. A hot top for an ingot mold and the like, said hot top comprising a plurality of end adjacent preformed elongated sideboards, means for suspending said sideboards adjacent corresponding wall surfaces of said ingot mold, each of said sideboards having a pair of downwardly and outwardly inclined grooves formed on the inward face thereof and disposed near the ends thereof respectively, whereby the inclination of each pair of grooves on respectively adjacent end portions of said sideboards have a downward convergency, and means insertable into each of said pairs of adjacent grooves and movable therealong to points of bearing contact with said sideboards adjacent the lower edges thereof for restraining said sideboards flushly against said wall surfaces and for engaging forcefully at least portions of said sideboards adjacent said edges with said wall surfaces to prevent said sideboards from floating when said ingot is poured into said mold.

2. The combination according to claim 1 wherein said retraining and engaging means include a number of spring hooks of generally U- or V-shaped configuration, said hooks being so shaped that they are increasingly compressed as they are moved along said pairs of grooves, respectively.

3. The combination according to claim 1 wherein said restraining and engaging means include a number of wedge plates, each of said plates being so shaped that insertion of said plates into respective pairs of said adjacent grooves and movement therealong causes increasing forces to be applied to the associated sideboards to press at least the lower edges of said sideboards into close fitting engagement with said mold.

4. The combination according to claim 2 wherein a stop member is formed at the lower end of each of said grooves and adjacent the lower edge of the associated one of said sideboards to limit the downward movement of said spring hooks.

5. The combination according to claim 2 wherein the end portions of each of said spring hooks are bent inwardly to provide a smooth engagement with the bottoms of said grooves.

6. The combination according to claim 1 wherein the cross-sectional configuration of each pair of adjacent grooves are inclined generally toward one another to facilitate retention of said restraining and engaging means therebetween.

7. The combination according to claim 3 wherein each of said wedge plates are provided with opposed inclined edges, the inclination of said edges being slightly less than the inclination of said grooves so that said forces are concentrated adjacent the lower ends of said grooves and the lower edges of said sideboards.

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U.S. Cl. X.R.

249—202